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J Karkoski

June 8, 2005

Mr. Thomas Pinkos, Executive Officer
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670

Subject: Comments on Proposed Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Mercury in Cache Creek, Sulphur Creek, and Harley Gulch, Staff Report, May, 2005

Sacramento Regional County Sanitation District (the District) appreciates the opportunity to comment on the proposed Cache Creek Mercury TMDL. The District is submitting these comments to address significant elements of the proposed Cache Creek Mercury TMDL that are expected to be incorporated in the Delta TMDL for mercury, which will directly impact the District. The District is also submitting more detailed comments that address technical deficiencies in the subject document, in accordance with the format requested by Regional Board staff.

The District has significant concern with the following elements of the proposed TMDL:

1. **The methyl mercury control program outlined in the proposed TMDL is based on a misleading premise, i.e. that control of aqueous methyl mercury at specific locations in the Cache Creek watershed will have widespread, regional benefits in reducing fish tissue mercury levels.** This concept is flawed for two reasons: (1) Methyl mercury uptake into biota happens rapidly (i.e. control of specific methyl mercury sources will have localized rather than regional impacts) and (2) methyl mercury is produced in the aquatic system at unidentified locations throughout the watershed (an effect that will negate the benefits of localized control efforts). The purported relationship between aqueous methyl mercury and fish tissue (as shown in Figures 5.1 and 5.2 of the staff report) is used to support the proposed aqueous methyl mercury control program. As pointed out by peer reviewer Dr. David Sedlak of UC Berkeley, these figures, which rely on average conditions at different locations throughout the watershed, do not accurately predict the effects of methyl mercury management on a regional scale. As noted in comments by Dr. Ramzi Mahmood, professor of statistics at CSU Sacramento (see attached letter), the staff report fails to address the significant uncertainty in predicting fish tissue levels from methyl mercury concentrations. This failure leads to a false sense of security regarding our ability to manage mercury in the Cache Creek watershed.

The fundamental conclusion to be drawn is that the proposed aqueous methyl mercury program is based on a fundamentally flawed approach that fails to address key factors. As a result, the aqueous methyl mercury approach should not be expected to produce the regional fish tissue reductions asserted in the staff report.

The proposed implementation plan properly focuses on biggest single loads from mercury mines, but should not be expected to attain targets

2. The proposed prohibition on new sources or net increases of mercury or methylmercury in the watershed is an unreasonable and unsupported provision of the proposed implementation plan. The staff report provides no analysis of the costs or benefits of this watershed-wide prohibition. Such a provision could lead to widespread social and economic hardship in Yolo County, without a commensurate reduction in either mercury loadings or fish tissue levels. The failure of the staff report to provide a quantitative analysis of the connection between various implementation measures (including the proposed prohibition) and fish tissue target attainment is a serious deficiency of the proposed TMDL. This provision of the proposed TMDL should be eliminated.

Additional technical comments on the staff report are attached. Again, we appreciate the opportunity to provide these comments.

Sincerely,

Robert F. Shanks
District Engineer

RFS/VF:gjl (Cache Creek Mercury Letter 6-8-05)

Cc: Wendell Kido
Robert Seyfried
Vicki Fry

Attachments (2)

Detailed Comments

The following comments on the public review draft document and supporting materials from the perspective of the Sacramento Regional County Sanitation District (hereafter "District") are divided into three categories:

1. Linkage analysis,
2. Allocations, and
3. Implementation.

The format for these comments, as recommended by Regional Board staff, is to identify specific issues followed by discussion and specific suggested revisions. Comments supporting staff recommendations are presented in the same format.

A. Linkage Analysis Issues

The comments in this section address issues related to the analysis linking the implementation plan to attainment of beneficial uses.

Comment #A-1: The current load estimates presented throughout the report are inconsistent.

The following variations were readily found:

Page	Location	Statement
21	Table 3.4	Data in this table are not used in the linkage analysis.
63	2nd parag.	"Mercury loads at Rumsey currently average 400 kg/year."
64	2nd parag.	"The current suspended mercury sediment concentration discharging from the settling basin to the Yolo Bypass is 0.5 mg/kg and the 20-year average discharge is 125 kg/year." [these values are consistent with recent study findings]

Suggested Revision: Present a consistent analysis of load estimates.

Comment #A-2: The mercury reduction estimates are not presented in consistent terms.

Mass removed is not equivalent to a load reduction. Table 5.4 on p.61-62 indicates load reductions for "select remediation or removal of contaminated sediments…" in terms of total mass (20-200 kg for Cache Creek canyon; 20 kg at mouth of Harley Gulch).

Suggested Revision: Estimate a load reduction based on mass removed. The simplest estimate would be the mass divided by the number of years in which it would be expected to erode if not removed or stabilized. Provide technical support for the estimates of rate of erosion.

"Passive erosion…" is included in Table 5.4 as a load reduction. But in fact, this value represents the ongoing load not reduced.

Suggested Revision: Remove the inclusion of passive erosion as a load reduction.

Table 5.4 mixes total mercury and methyl mercury reductions. Estimates for each should be provided separately.

Suggested Revision: Produce two tables or two sets of columns – one for total mercury load reductions and one for methyl mercury load reductions.

Comment #A-3: The expected benefits of Implementation Alternative 2 are over-stated.

The actions required in Implementation Alternative 2 only address a portion of 15% of the methyl mercury load in the watershed. All of the Alternatives – not only the "do nothing" Alternative 1 – rely almost entirely on natural erosion processes to attenuate mercury levels in fish.

Suggested Revision 1: Remove references to monitoring, feasibility studies, and prohibitions on load increases from the list of actions to reduce mercury loads.

Feasibility studies, source identification studies, and prohibitions of increases in methyl mercury included on page iii-iv are not "actions to reduce mercury loads".

Suggested Revision 2: Assess the potential affect on total mercury concentrations caused by encouraging streambank erosion of mercury-laden sediments.

Comment #A-4: It is misleading to state that Water Quality Objective Alternatives 3 and 4 are less protective of bald eagles (p.33 and 40).

The objectives alternatives are presented as variations in the methodology for calculating objectives protective of the most sensitive human and wildlife consumers of fish. Alternative 2, which represents the lowest aqueous methyl mercury objective of the four alternatives, is the most <u>over</u> protective, not <u>more</u> protective.

Suggested Revision 1: Discuss in the TMDL the multiple layers of conservative factors applied to arriving at the proposed objectives for methyl mercury content in fish tissue.

Suggested Revision 2: Accept comments presented by Yolo County which provided a more appropriate (Alternative 4) calculation for fish tissue targets.

Comment #A-5: The uncertainty in the estimated aqueous methyl mercury concentration target should be clearly described in the analysis~~.~~ (p.43~~–~~-45).

The analysis shown in the attached letter from Dr. Ramzi Mahmood illustrates the effects of uncertainty in the regression analysis to derive a target concentration expressed as a percentile (as opposed to a point estimate). Using this approach requires developing the probability distribution of the concentration of methyl mercury concentration in the aqueous phase. The inherent variability in the regression model (an effect caused by few points), severely limits its ability to predict the actual impact of reduced methyl mercury concentrations.

Suggested Revision 1: The effect of averaging methyl mercury concentration for each stream on the regression model needs to be evaluated. The averaging process should also be considered when developing a monitoring plan to determine the effectiveness on any implemented best management practices (BMP).

Suggested Revision 2: Develop a monitoring program that would allow for better prediction of the aqueous mercury concentration that incorporates the variability in the system.

B. Allocation Issues

The comments in this section address issues related to the allocation of loads and reductions intended to protect beneficial uses.

Comment #B-1: Expressing the load allocations as % of existing load in Tables IV-7 and IV-8 is confusing and unnecessary.

The "% of existing load" values are useful for reference, but are not themselves loads. The "Acceptable Annual Load" values essentially represent the TMDL load allocations with no explicit safety factor. A 10% margin of safety is, although completely arbitrary, pragmatic. However, it is employed in a confusing manner as representing an additional source.

Suggested Revision: Replace the "% of existing load" column with load allocations calculated as 90% of the Acceptable Annual Load, in units of g/yr.

Comment #B-2: The three-part process of accomplishing reductions in methyl mercury concentrations (p.42) excludes the most relied upon process of all: natural attenuation.

The mine site tributaries are noted to represent approximately 15% of the mercury load in the watershed. The TMDL should recognize that both Alternative 1 ("do nothing") and Alternative 2 rely entirely versus predominately on natural attenuation.

Suggested Revision: Include natural attenuation in the "process" discussion, including technical support for the projected timeline (500 years) to attain fish tissue targets.

C. Implementation Issues

The comments in this section address issues related to the implementation plan.

Comment #C-1: Discussions of the phased approach are inconsistent throughout the text.

The following variations were readily found:

Page	Location	Statement
7	Bottom	Describes a three-part process

9	3rd parag.	Describes the implementation as a two-phase approach. The first phase is described as "generally requires…additional monitoring…and feasibility studies…"
10	Table IV-9	Summarizes implementation with no clear relation to any phases
14	2nd parag.	Indicates that the TMDL will be revisited in five years
42	4th parag.	Describes a three-part process
42	Bottom	Staff proposes a four-part program

The processes described do not fit consistently within the phased approach, such that there is no way to tell which processes are expected to occur in phase 1 or future phases.

Suggested Revision 1: Remove discussions of a process and refer simply and consistently to implementation phases.

Suggested Revision 2: Be more pragmatic and coherent in presenting the phased approach.

Comment #C-2: The schedule for Phase 1 of the TMDL requires Regional Board staff to be involved with several activities that will not result in any measurable water quality benefit.

The Regional Board should be concerned that this draft TMDL would reduce staff time available for the other ~35 mercury TMDLs in the region that eventually need to be developed. Required actions that detract Regional Board staff from mine site remediation activities are not an effective use of available resources.

Suggested Revision 1: Focus phase 1 of the TMDL implementation plan on mine site remediation.

Suggested Revision 2: Relegate all other implementation actions to phase 2, which should commence 20 years after mine site remediation has been completed. Include provisions to re-calculate appropriate targets and to consider the attainability of uses in developing phase 2.

Comment #C-3: The TMDL compliance schedules for the Delta and San Francisco Bay downstream are to be aligned. The implementation plan for this TMDL should consider the compliance schedules imposed for those downstream water bodies.

Regional Board staff describes the Cache Creek watershed as representing half of the mercury load to the Delta. The San Francisco Bay mercury TMDL likewise estimates that approximately one-third of the load to the Bay is from the Delta.

Suggested Revision: Include information on the proposed compliance schedule for this TMDL in discussions of downstream TMDLs.

Comment #C-4: The cost estimates for all alternatives are completely unrealistic and do not reasonably fulfill the State's obligation to consider economic impacts of its regulations.

The cost estimate for ~500 years of public outreach is $20,000. That's $40/yr, which is highly unlikely to provide any effective outreach. This figure should be adjusted to accommodate an appropriate and specific public outreach implementation plan. The Alternative 2 cost estimates are based on a roughly

30-year life cycle, while the compliance schedule is potentially hundreds of years. The remediation costs presented also do not include substantial monitoring, regulatory oversight, project management (e.g., data management, compliance reporting, studies, negotiations), legal liability risk minimization, and various other costs associated with the implementation plan. These factors would likely double the cost of implementing the TMDL <u>for the mine site remediation projects alone</u>.

Costs associated with site characterizations, watershed monitoring, source tracking, feasibility studies, compliance reporting, regulatory oversight, and project-level negotiations imposed by the TMDL are likely several millions of dollars.

Suggested Revision: Present all realistic costs of implementing the TMDL, based on a minimum 100-year compliance schedule. Develop a specific public outreach implementation plan and a credible cost estimate (DHS's Delta Fish Project is a good resource for appropriate plans and costs) given the projected 500-year timeline to accomplish fish tissue reductions.

Comment #C-5: The District appreciates the consideration of offset programs in the TMDL (p.13, 46, 47, 51, 53, 54, 57, 58). But requirements in the TMDL may still make projects unattractive because of the liability risk.

Concerns related to the liability risk are addressed as specific comments below (see comments #C-5 and C-6).

The District notes that there is no offset program yet developed, and recommends that staff focus near-term activities on developing a feasible offset program in collaboration with impacted permittees.

Comment #C-6: Requirements to measure a 95% load reduction from mine sites is unnecessary and imposes a liability risk that will deter action.

The best information available on how to clean up the mercury mine sites is a report by TetraTech EM for Calfed. The remediation <u>costs</u> presented in the TMDL (Table 5.6) are largely based on the information in this report. Remediation <u>effectiveness</u> presented in the TMDL is based on a suggested remediation goal and anecdotal evidence that, "the total metal loading from many remediated copper and zinc mines in the Central Valley has been reduced by 90-100% (Personal communication from Regional Water Board Redding staff)."

Measuring a 95% reduction of mercury loads from mine sites would require extensive pre- and post-project monitoring. Indeed, Section 6.2 (p.71) "requires" intensive, multi-year monitoring of multiple parameters for any mine remediation project. Section 6.3.1 (p.72) is inconsistent in that it provides that "as an interim tool…mine owners could propose to frequently monitor Hg/TSS."

The purpose of monitoring mine site remediation projects elsewhere has been to provide a reasonable expectation of the ability of clean-up activities to prevent mercury transport off site. Monitoring for each project site should be prescribed based on best professional judgment and site-specific monitoring rather than dictated in the TMDL.

The text notes (p.65) that "mines in the Sulphur Creek [sic] should be able to meet reduce erosion and mercury loading by 90-95%." But anything <u>less</u> than

95% reduction would be non-compliant with the TMDL load allocations. One question that any potential project proponent will consider is "what if remediate according to plan, monitor throughout, and determine that loads were reduced by less than 95%?" One could do no more, yet liability to a third-party lawsuit will remain indefinitely.

Suggested Revision: Agree prior to remediation action on a load reduction estimate based on existing information (e.g., 95%) and have a goal – but do not regulate on the basis – that accomplishing the clean-up and maintaining the project site will result in the estimated load reduction.

Comment #C-7: Absolute requirements for no net increase or elimination of loads may be impossible to attain, thus exposing every project, regardless of size, to unreasonable liability and potentially halting any water management changes and land development.

Ultra-clean sampling and analysis methods for methyl mercury can detect trace amounts of the substance in aquatic samples. To "eliminate" the methyl mercury load would require proof that methyl mercury concentrations were not detected in water discharged from a wetland, for example. This would be impossible even for water discharged from a pristine wetland.

Suggested Revision: Remove all reference to any requirements for controls other than mine site remediation. Or, require that best management practices to minimize mercury loads from other sources be implemented.

Comment #C-8: Requiring projects to control erosion is inconsistent with the primary loss mechanism of natural attenuation (i.e., streambank erosion).

Streambank erosion and deposition processes are largely driven by the stream's turbulence and sediment load. Controlling erosion at project sites will result in reduced sediment load downstream of those areas. But the sediment carrying capacity of the streams would remain the same. The most likely result, therefore, would be <u>increased erosion of streambanks</u> in the main channel, not burial. Indeed, the primary mechanism expected to reduce mercury loads in the creeks is natural erosion of mercury-laden streambanks.

Requiring that any streambank project <u>not</u> allow that natural process to occur is inconsistent with the goal of reducing the amount of mercury-laden sediment in the watershed.

Suggested Revision: Require that best management practices be implemented for projects that could otherwise cause erosion of mercury-laden sediments into the creeks.

CALIFORNIA STATE UNIVERSITY, SACRAMENTO
Department of Civil Engineering

Ms. Vicki Fry, P.E.
Associate Civil Engineer
Policy & Planning Division
Sacramento Regional County Sanitation District
10545 Armstrong Avenue, Suite 101
Mather, California 95655

June 2, 2005

Dear Ms. Fry:

I am writing in response to your request to review and evaluate the statistical approach that was used in the **Cache Creek, Bear Creek, and Harley Gulch TMDL for Mercury, Staff Report** (Regional Water Quality Control Board, Central Valley Region, 2004). I adjusted my comments to the most recent amendment of the report that was issued May 2005. The fish tissue data were obtained from UC Davis (Slotton et al. 2004). My comments are focused on the methodology and the predictions tools used in the report. As a general comment the staff at the RWQCB has compiled a lot of data that help to design future studies to identify sources of mercury in different streams within the system and develop best management practices to control the sources. Based on the data compiled in the report we know that a reduction in mercury within the streams should be associated with a reduction of mercury in fish tissue. However, quantifying this reduction at this point is questionable. The methodology is focused on calculating a point estimate for the methyl mercury target goal in the aqueous phase without incorporating the variability inherent in the estimate (more detailed discussion is included below). I made another comment on the methodology of regression analysis that I reviewed in the original document. However, I did not include these comments. The focus of the comment was on including influence points in the regression analysis. An influence point is defined as a point that has a significant influence on the slope of the regression line if the point is removed from the analysis. For example, Figure 3-5 in the original document illustrate regression analysis with influence point. I am not sure the relevance of the original document at this stage. However, I will be happy to give you more details if needed.

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Linkage Analysis:

The staff report derives a target methyl mercury concentration in the aqueous phase. In the original document, the aqueous concentration was calculated based on a two-step process. The first step was to determine the concentration of mercury in invertebrate tissue for a given target concentration in fish tissue (fish tissue concentration versus invertebrate tissue concentration). The second step is to calculate the corresponding aqueous mercury concentration based on the invertebrate tissue concentration that was determined in the first step. In the amended document, the staff modified the approach by using mercury data for fish and water directly without using the chained relationship (fish to invertebrate and invertebrate to water). The latter approach has two problems: 1) A complex stream system was simplified as one system by combining the data from different streams within the system (that is, site specific conditions and mechanisms that affect mercury concentration are ignored by combining the data for the whole system of streams), and 2) Propagation of uncertainty in the aqueous mercury concentration is more complex due to the two-step process of deriving a target concentration. The new approach of using fish and water data directly reduces the uncertainty in the regression analysis compared to the uncertainty of the two-step process that was originally proposed. However, the uncertainty in the estimated aqueous concentration target should be taken into consideration when deriving a target goal. The uncertainty in the methyl mercury target concentration is described below.

The process of deriving a value for the independent variable from a given value of the dependent variable is known as the inverse prediction problem (or calibration). That is, given a value for the dependent variable (concentration of total mercury in fish tissue), find the corresponding independent variable (methyl mercury concentration in aqueous phase, Figures 5.1 and 5.2 in the amended report). The mathematical detail of this analysis is discussed in "**Statistical Methods and Data Analysis, Fifth Edition, by Ott and Longnecker (2001)**." A single observation (in this case is 120 or 230 ng/g ww) generates a range of x values because of the variability inherent in the dependent variable. That is, each value of y "casts a shadow" on the x axis (as illustrated in schematically in Figures 1 and 2). The 95% confidence intervals for the TL3 and TL4 fish are shown in Table 1 below. These numbers were calculated using JUMP IN 5.1 (see attachment).

Table 1. The 95% Confidence Interval for the Aqueous Methyl Mercury Target

Case	**MeHg in Fish (ng/g ww)**	**Aqueous MeHg (ng/L)**	**95% Confidence Interval**	
			Lower Limit	**Upper Limit**
TL3	120	0.15	0.10	0.20
TL4	230	0.14	0.00[1]	0.20

[1] The actual calculated lower limit is negative.

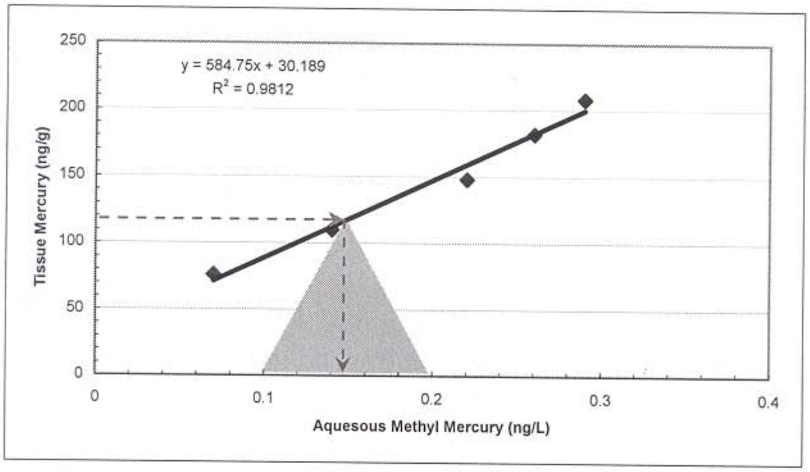


Figure 1. Illustration of Inverse Prediction Confidence Interval for TL3 Fish versus Aqueous Methyl Mercury

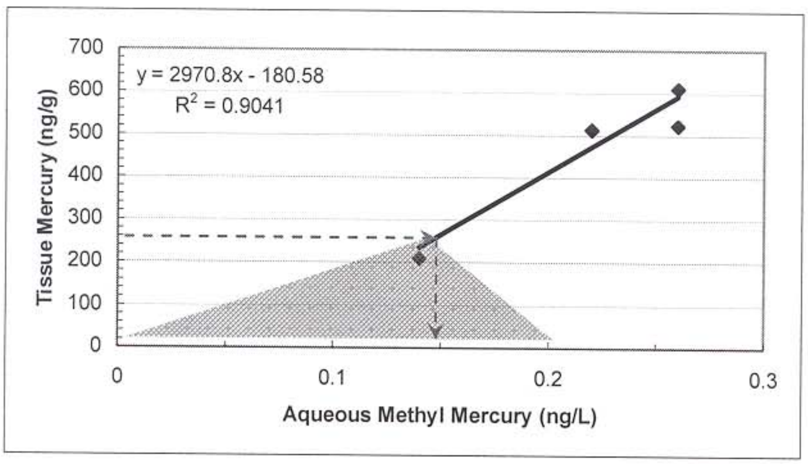


Figure 2. Illustration of Inverse Prediction Confidence Interval for TL4 Fish versus Aqueous Methyl Mercury

The analysis shown above illustrates the need to incorporate the uncertainty in the regression analysis to derive a target concentration expressed as a percentile (as opposed to a point estimate). Using this approach requires developing the probability distribution of the concentration of methyl mercury concentration in the aqueous phase. Otherwise, it will not be feasible to quantify the benefit realized by a given reduction in mercury concentration in a stream. This is due to two factors: 1) the inherent variability in the regression model (few points), and 2) the concentrations in the aqueous phase data (that were used in the regression analysis) were represented as an average concentration in each stream. The effect of the latter factor (averaging methyl mercury concentration for each stream) on the regression model needs to be evaluated. The averaging process should also be considered when developing a monitoring plan to determine the effectiveness on any implemented best management practices (BMP).

Based on my analysis, I recommend the following: 1) Use a phased approach and focus on source identification and reduction, and 2) Develop a monitoring program that would allow for better prediction of the aqueous mercury concentration that incorporates the variability in the system. If you have any question, please contact me.

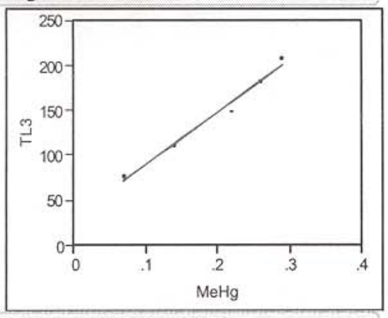
Sincerely,

Ramzi J. Mahmood, Ph.D., P.E.
Professor

Response TL3

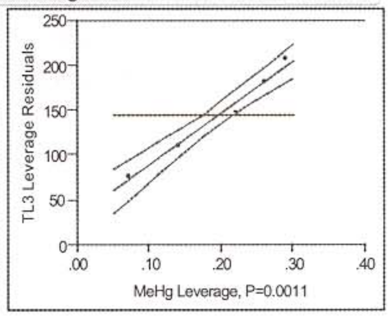
Whole Model

Regression Plot

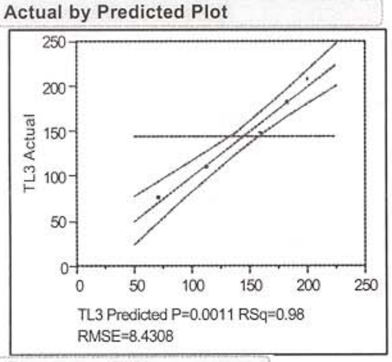


MeHg

Leverage Plot



Actual by Predicted Plot



Summary of Fit

RSquare	0.981184
RSquare Adj	0.974912
Root Mean Square Error	8.430795
Mean of Response	144.8
Observations (or Sum Wgts)	5

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	11119.565	11119.6	156.4410
Error	3	213.235	71.1	Prob > F
C. Total	4	11332.800		0.0011

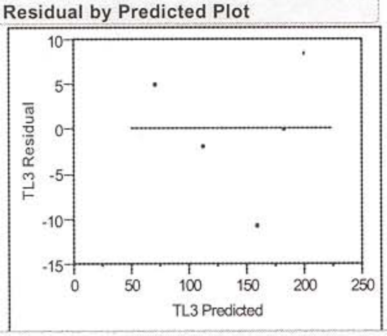
Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	30.189422	9.90862	3.05	0.0556
MeHg	584.74785	46.75126	12.51	0.0011

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
MeHg	1	1	11119.565	156.4410	0.0011

Residual by Predicted Plot



Inverse Prediction

TL3	Predicted MeHg	Lower Limit	Upper Limit	1-Alpha
120.00000	0.153588557	0.097413549	0.203892025	0.9500

Confidence Interval with respect to an individual response

Inverse Prediction

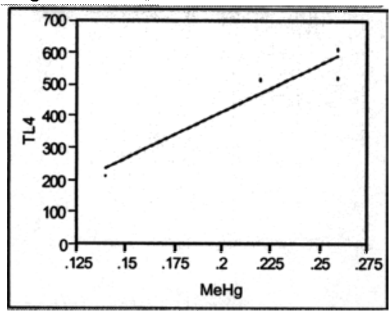
TL3	Predicted MeHg	Lower Limit	Upper Limit	1-Alpha
60.00000	0.050980227	-0.02431026	0.106193837	0.9500
120.00000	0.153588557	0.09741355	0.203892025	
180.00000	0.256196887	0.20587081	0.314856767	
200.00000	0.290399663	0.23896139	0.354906847	
240.00000	0.358805217	0.30178836	0.438361209	

Confidence Interval with respect to an individual response

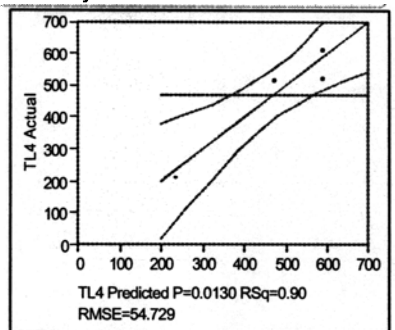
Response TL4

Whole Model

Regression Plot



Actual by Predicted Plot



Summary of Fit

RSquare	0.904114
RSquare Adj	0.872152
Root Mean Square Error	54.72913
Mean of Response	473
Observations (or Sum Wgts)	5

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	84728.167	84728.2	28.2872
Error	3	8985.833	2995.3	Prob > F
C. Total	4	93714.000		0.0130

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	1	5200.8333	5200.83	2.7481
Pure Error	2	3785.0000	1892.50	Prob > F
Total Error	3	8985.8333		0.2392
				Max RSq
				0.9596

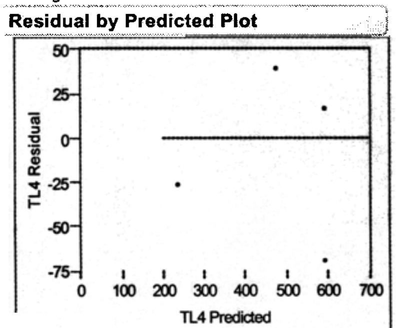
Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-180.5833	125.3006	-1.44	0.2452
MeHg	2970.8333	558.5769	5.32	0.0130

Effect Tests

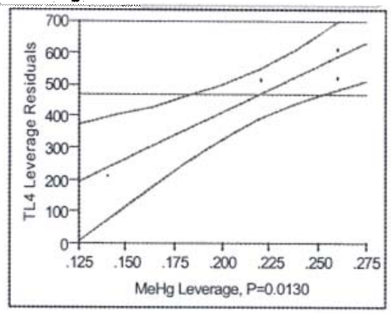
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
MeHg	1	1	84728.167	28.2872	0.0130

Residual by Predicted Plot



MeHg

Leverage Plot



Response TL4

Inverse Prediction

TL4	Predicted MeHg	Lower Limit	Upper Limit	1-Alpha
50.00000	0.077615708	-0.15683906	0.153246701	0.9500
100.00000	0.094446003	-0.11742588	0.166267603	
150.00000	0.111276297	-0.07857079	0.179846599	
200.00000	0.128106592	-0.04045431	0.194164200	
250.00000	0.144936886	-0.00332454	0.209468514	
300.00000	0.161767181	0.03248425	0.226093814	

Confidence Interval with respect to an individual response

Inverse Prediction

TL4	Predicted MeHg	Lower Limit	Upper Limit	1-Alpha
230.00000	0.138204769	-0.01803876	0.203209105	0.9500

Confidence Interval with respect to an individual response